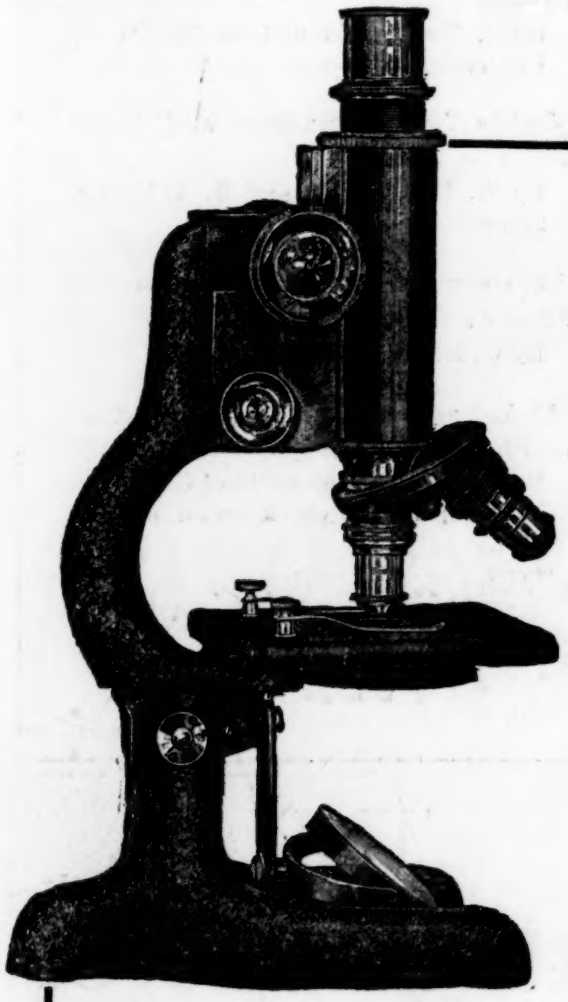
APR 28 1917
UNIV. OF MICH.
LIBRARY

SCIENCE

NEW SERIES
VOL. XLV. No. 1165

FRIDAY, APRIL 27, 1917

SINGLE COPIES, 15 CTS.
ANNUAL SUBSCRIPTION, $5.00



Bausch and Lomb

Microscope FS 2

$34.00

Model FS is built to withstand the rough usage of the laboratory. It has the new, crystal black finish which does not mar or show finger-marks like the smooth lacquer. The long curved arm leaves the stage entirely free for manipulation of the specimen; the rounded edges make for ease of handling and freedom from dust.

The fine adjustment is of our lever type, which is simple and durable. The fine focusing heads are located on both sides of the arm conveniently in line with the coarse adjustment heads. The fine adjustment ceases to act when the objective touches the slide and positive stops denote the limit of motion.

Write for Circular

Bausch & Lomb Optical Co.

409 ST. PAUL STREET ROCHESTER, N.Y.

New York Washington Chicago San Francisco

Leading American Makers of Photographic Lenses, Microscopes, Projection Lanterns (Balopticons) Stereo-Prism Binoculars and other High-Grade Optical Products

GRAND PRIX—PANAMA-PACIFIC EXPOSITION

COULTER'S Botanical Notebook and Laboratory Manual

A VALUABLE adjunct to the author's textbook, Plant Life and Plant Uses. Each of the seventy-two exercises contains at least one "thought question," and the directions and questions are clear and definite.

The aim is to develop thought as well as to provide for organization and expression. Properly employed as a record of the pupil's real self, this notebook will be to the teacher a reliable guide as to how best to direct his further development.

American Book Company

New York Cincinnati Chicago Boston Atlanta

Field Manuals

A Laboratory and Field Manual of Botany
By J. Y. Bergen and B. M. Davis, University of Pennsylvania, 90 cents

A Guide for Laboratory and Field Work in Zoölogy
By H. R. Linville and H. A. Kelly, 25 cents

Laboratory and Field Exercises in Physical Geography (*Revised Edition*)
By G. H. Trafton, 40 cents

Field, Laboratory, and Library Manual in Physical Geography
By T. Wright, University of California, 75 cents; with notebook bound in, $1.00

Ginn and Company

Boston New York
Chicago London

UNIVERSITY OF CALIFORNIA PUBLICATIONS

The University of California issues publications in the following series among others:

Agricultural Science
American Archeology and Ethnology
Botany
Economics
Geology
Mathematics
Pathology
Philosophy
Physiology
Psychology
Zoology
Memoirs of the University of California
Bulletin and Publications of the Lick Observatory

RECENT TITLES

Experiments on the Effects of the Constituents of Solid Smelter Wastes on Barley Growth in Pot Cultures, by C. B. Lipman and W. F. Gericke ..... .95

Certain Effects under Irrigation of Copper Compounds upon Crops, by R. H. Forbes 1.00

Plantae Mexicanae Purpusianae VIII, by Townshend Stith Brandegee ..... .15

Recent Studies of the Skull and Dentition of *Nothrotherium* from Rancho La Brea, by Chester Stock ..... .30

Systematic Position of Several American Tertiary Lagomorphs, by Lee Raymond Dice ..... .15

Osteological Relationships of the Three Species of Beavers, by F. Harvey Holden ..... .40

On Some New Species of Aphroditae from the Coast of California, by Christine Essenberg ..... .35

Complete list of titles and prices will be sent on application

THE UNIVERSITY PRESS - - - Berkeley, California

THE PRINCIPLES OF STRATIGRAPHY

BY

AMADEUS W. GRABAU, S.M., S.D.

PROFESSOR OF PALEONTOLOGY IN COLUMBIA UNIVERSITY

"Should be on the reference shelf of every college, normal school, and large high school in the United States."—*Journal of Geography*, Vol. XIII, Jan. 1915.

8vo, 1150 pages, 264 illustrations. Price, $7.50

Descriptive Circular Sent upon Request

A. G. SEILER & CO.

NEW YORK CITY

SCIENCE

FRIDAY, APRIL 27, 1917

CONTENTS

The American Association for the Advancement of Science:—

Personality as Revealed by the Content of Images: PROFESSOR LILLIEN J. MARTIN.... 393

The Industrial Fellowships of the Mellon Institute: DR. R. F. BACON 399

Scientific Events:—

Grants for Scientific and Industrial Research in England; The General Medical Board of the Council of National Defense 403

Scientific Notes and News 405

University and Educational News 407

Discussion and Correspondence:—

A Viable Ten-year-old Culture of Bacillus paratyphosus beta: DR. M. W. LYON, JR. *A Method for Killing Turtles:* NEWTON MILLER 408

Scientific Books:—

MacMahon on Combinatory Analysis: PROFESSOR JAMES BYRNIE SHAW 409

Special Articles:—

Inheritance of Oil in Cotton: E. P. HUMBERT 411

The American Association for the Advancement of Science:—

Section D—Mechanical Science and Engineering: PROFESSOR A. H. BLANCHARD 412

Minutes of the Council 415

Financial Report of the Permanent Secretary 416

MSS. intended for publication and books, etc., intended for review should be sent to Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

PERSONALITY AS REVEALED BY THE CONTENT OF IMAGES[1]

CHARACTER study and the investigation of personality have recently assumed, on account of the present tendency to apply psychology, a psychological importance they did not formerly possess, and since it has given rise to a general interest in any work looking towards the possibility of getting additional information regarding the individual consciousness, it has seemed to me I could not do better to-day than to outline the results of an investigation which I have made to ascertain whether it is possible through the examination of the content of an individual's images to obtain an insight into the predominating features of his personality, that is, the psychical and physical activities which characterize and distinguish him from others.

The experiments were made with 20 persons, largely professors and students connected with the Stanford University. In half of these experiments (S.) the observers allowed visual images to arise of themselves and in the other half (V.) they aroused them. It is scarcely necessary to add that the experiments were *"unwissentlich."*

The most important fact that comes out in examining the tabulated results and what was given to protocol is *that visual images reveal the mental and physical peculiarities and preferences of an individual.*

In what follows, I shall take up in detail the results of but 3 observers, to show that the data ob-

[1] Address of the vice-president and chairman of Section H, Anthropology and Psychology, American Association for the Advancement of Science, New York meeting, December, 1916.

tained reveals the observer's personality, that is, his mental and physical activities as shown by what has been stated concerning him in "Who's Who in America" (W.), "American Men of Science" (C.), his general reputation in the university community, the opinion that his intimate friends have of him, my own knowledge of him, and by what he himself said at the close of the experiments when questioned regarding the personality-revealing power of the content of the images he had reported.

The first individual results to which I wish to direct especial attention are those obtained with R.—(C.W.)—professor of electrical engineering at Stanford University, formerly at Cornell. Born in 1866. Has not traveled in Europe. At the time of the experiments was preparing for a demonstration and discussion at the approaching summer meeting of the American Association for the Advancement of Science of the insulation of electric currents at high voltage.

R.'s images for the most part as regards frequency follow the general time law. The interesting peculiarities to note are that the willed images have, more frequently than the spontaneous, an imaginative character, and that the future gives more images in the case of willed images than of spontaneous. That is, the imagination images are concerned with the future; they have a creative rather than a reminiscent character and have more largely to do with electrical work. The difference in content between the spontaneous and willed images of R. is due doubtless to the course of training as regards the putting aside of his electrical and, indeed, of all work of an inventive character during the hours devoted to rest, which he has been obliged to give himself in order to restore and preserve his health.

R.'s images are connected with the east, where he has engaged in electrical work, with Stanford University, especially his laboratory and home, with the Panama-Pacific Exposition in San Francisco, with Owens Valley and La Jolla, where he watched the construction of the Los Angeles Aquatic Power Project as consulting electrical engineer, and with places where he has gone on pleasure excursions in his automobile, as, for example, a series of views on a drive from San Francisco and San José to Stanford.

People, interiors (his own laboratory, particularly), electrical instruments and machinery, automobiles, electric cars and landscapes, especially the scenes along a country road, are evidently of the greatest interest to R. It is noticeable that when he uses his will, not people or landscapes are the image-producers, but his work as an electrician, the improvement and adaptation of electrical instruments and machinery that he contemplates taking up in the near future in getting ready for the demonstration just mentioned.

Through curtailed summary just given of the content of R's images I am able to give but a very general idea of the information conveyed through them regarding his mental and physical activities. The results, however, obtained with him and with the other observers do show that through using the image method one is able to obtain very detailed information regarding a person's individual peculiarities.

W.—Major in history, Stanford University. Born 1890 in Los Angeles, where his family has since lived. Captain of the baseball team. Visited Japan and Hawaiian Islands with the team in 1913. The experiments were made during the baseball training season.

W.'s spontaneous images are largely confined to the present and to Stanford University. Those that are willed also include images of the trip he made with the team. His Stanford images show that his thought is taken up with the men of the baseball team, the athletic field, the training house, and with other places and things connected with the playing of baseball. The images give, without doubt, a true picture of the life of a college student devoted to athletics. It is said this observer has been tempted to give up the idea he formerly had of going into scientific farming and has even seriously considered devoting himself to professional baseball. One is made to realize more fully in examining these images how college athletics may largely absorb a student's thought and become, as in this case, a menace as far as the particular student is concerned to the college itself as an intellectual center.

FF.—Born in Palo Alto in 1901 and has lived there continuously, except for a year and a half spent in the eastern part of the United States and the eleven summers of perhaps four weeks each, spent at Carmel, and the four summers of eight weeks each at Tahoe. Up to within a year or so she studied at home, but is now in a private school.

As to time, FF.'s images follow the law, except that their number is greater in 1909–07 than in 1911–10. This is probably due to the fact that a year and a half of this time was spent in the eastern part of the United States, for the majority of the images of this period are reproductions of occurrences connected with this eastern visit.

As to location, FF.'s images have to do with Palo Alto (her home, school, etc.), the places where her summers have been largely spent (Carmel and Tahoe) and with the experiences, as was said, of the year and a half residence in the east. The year in the east, considering the time involved, has a very much greater image-producing power than has her own home in Palo Alto. The same is true of her life at Carmel and Lake Tahoe, the last furnishing more images than does Carmel, where she spent more time and the time was more distributed. The importance of vacation periods in the intellectual life clearly comes out here, as well as in case of some of the other reagents.

I suspect the pleasure-giving power of an image often determines its arousal in FF.'s case. At any rate, no image of her experiences at Carmel in 1906, when she had scarlet fever and suffered a great deal, arose, and moreover, every one of her images has an agreeable content and she showed much pleasure in describing them. Not only pleasure, but the newness of an experience is also, doubtless, an important factor as regards its being imaged. This explains probably why FF. reproduces in her images so rarely the members of her own family, to whom she is devoted. One must not, however, over-emphasize pleasure and interest as image-producing factors in her case, for the results show other factors often enter in and control their arising. For example, FF. went to the Exposition two days during the time the experiments were being carried on and was greatly interested and took much pleasure in what she had seen, but the fifteen images recorded after her return from the Exposition do not reproduce what she saw there.

FF.'s predominating interests are evidently those enumerated by her mother, before she knew the distribution of her images—Tahoe, Carmel, people, school, horses, in fact, all animals, plants, especially flowers, water and landscapes. Some of the images classed under people had a landscape background or were accompanied by another image-arousing subject such as an animal; a person, for example, was on horseback, or a dog or cat was with a person, but such images as to content have been classed under people, because it was quite evident that the person or persons were the real centers of interest. That FF. is a close observer, as her mother says, is evident from the presence of details in her images which most persons would not have noticed in examining the particular object visualized, as for example, the way in which the sunlight fell upon certain parts of a dress, was reproduced in them.

A comparison of FF.'s images with those of her brother LF. shows that her visualizations are much more personal and in general less valuable as regards content. LF. for example visualized Lake Michigan, an aeroplane at the Exposition, the plains in New Mexico, scenes described in a book on the south pole, speed boats at the Exposition, views of Pittsburgh, a glacier, picture of Whistler, harbor at Sandusky, etc. FF. Gertrude Jones on her wheel, Mrs. Jordan at a picture, Dr. Lane shooting at little cans, Mrs. Ely with a rose in her hair singing, etc. As FF. is an intelligent girl, it is probable that the unimportant content of her images is due to her secluded education and the greater emphasis laid by those who have had to do with it on the less important matters of life. What is true of the content of FF.'s images is also true of the images of the other girls who took part in the experiments.

The results with FF. show very clearly the diagnostic significance of these experiments from an educational standpoint. FF.'s mother, with whom I studied the results, I found later, had made an application of what she had learned. FF.'s reading had been altered and family discussions were now more often connected with matters of world interest.

The results also show that *visual images reveal the attitude of an individual as regards the world around him.* The activities pictured in the image and the observer's relation to such activities show whether he is a participator, an actor in the scene, or only an observer of it, that is, whether an objective or subjective attitude of mind marks him.

Before leaving the discussion of the general facts it ought to be said, perhaps, that the results do not show that a study of a person's visual images alone, even where such images are very strong and detailed, will *completely* represent his personality. To obtain such a representation, as well as to determine the laws of thought in general, not only must the content of other images, as the tactile, auditory and kinesthetic, be studied in themselves and in a comparative way but the relative signif-

icance of each kind of imagery in the observer's life should be investigated. His imageless thought should also be examined. Taine, in saying that the laws of thought can be determined by studying images, was only correct in the main. There is, as I have previously shown, some of our thinking which is not represented by images, even in case of those having a strong visual memory which is actually measurable and this *unanschaulich* residue must not, of course, be neglected in a complete investigation of personality.

Where an observer does not have visual images other images could doubtless be similarly employed, but where he has fairly strong visual images their use is to be preferred, in that an observer is instructed to examine a thing having a reality and objectivity comparable with that of a positive and negative after-image, where the possibility of measurement is universally admitted. What I mean to say is that in examining visual images a reagent's observing powers are called into play as they would be in making a study of a sensory object and the demands made upon his introspective powers are therefore much less than in examining other images and imageless thinking.

The results of another series of experiments where the observer was instructed to arouse, respectively, let arise, a feeling image or experience, showed that not alone the sensory image, but also the feeling image or experience method, should be employed, as in some observers emotion plays so important a rôle as even, for example, to transform major image centers into minor and vice versa. Not alone as a matter of confirmation and supplementation should the feeling image method be used, but to obtain information concerning the energizing and non-energizing effect of emotion as regards thinking and acting.

Supplementation and modification of the series just outlined would be desirable as, for example, the effect on imagery of shifting the environment systematically, or, again, experiments in which the experimenter suggested the subjects of the images would be useful in showing the initiative imaging and thinking power of an observer. In reading a piece of poetry or prose, one is often able to represent what is presented, but is painfully aware that he has not sufficient intellectual initiative power in the particular direction to have had the images and ideas arise spontaneously.

The tabulations show further that

Memory images predominate in the visualization of the observers.

Certain subjects are more likely to be reproduced in the form of imagination images by some observers than others.

Memory images are usually definitely located as to the time of the corresponding experience.

The shorter the time since an experience occurred, the greater the probability of its being visualized.

The probability of the visualization of a more recent experience does not decrease with the age of the observer, as might have been expected from Ribot's investigations.

The observer's present environment is often determinative as regards the images which arise.

Certain places, objects and activities are more likely to be visualized.

While the range of visualization as regards time, place and subjects, differs with different observers, it is in general constant in case of the same observer.

The range of visualization as regards the amount included in the image differs.

Previously connected experiences are evidently not as closely bound together above

and below the threshold of consciousness in case of some of the observers as of others.

The time taken for the arising of spontaneous and willed images varies greatly in the same and different observers.

With some observers the preimage, that is, subconscious mental activity, is much more frequent and has much more influence as regards the kind of willed image that arises.

Subconscious activity is sometimes revealed in the willed images that arise.

The spontaneous images give a survey of the static and dynamic condition of the subconscious.

The following is a brief summarization of some other matters of practical and theoretical interest brought out by the examination of the experimental results: It is possible through using the image method, to determine the richness and poverty of the subconscious in a given individual as regards quality and quantity; his tendency to react along the lines of habit-thought (spontaneous ideas and images); whether he has naturally or has acquired the ability to direct the course of his thought, in short, whether he is really able to free himself from habit-thoughts and start new lines of thinking; to ascertain how to enrich or render non-effective, when desirable, what is subconscious in an individual; to foretell the probable effect of a given environment, as regards momentary thinking and the storing up of thought material upon a particular observer and upon observers in general, and the length of residence most desirable as regards such storing up; again, the prevailing thought-constellations in a given observer can be ascertained through the method as well as whether it is possible and desirable to strengthen such natural groupings or to break them up through education; whether the levels and strata of the subconscious in a given observer can and should be shifted; also, whether marked vacillations of attention in a person are not sometimes due to persistent preimages and if so whether it is not possible for such images to be excluded or transformed into more useful forms; again, whether work may not sometimes be more rapidly and effectively done by an observer by letting himself go and waiting for the problem to solve itself under the threshold of consciousness and spring into consciousness, that is, whether too much or too little emphasis is being laid on will in his case; to make out whether permanency or vacillation characterizes a person's thinking and the effect of this on his life as an actor; to get at the strength of will of an observer and to determine the possibility of weakening or strengthening it; to determine the direction and strength of a reagent's memory and imaginative power for the purpose of getting information concerning his ability and weakness along observational lines and correcting them where desirable; to decide whether it is better to let one's subconscious thinking take care of itself or to make an effort to educate it; to examine the effect of weariness and sickness on an individual's intellectual life, as it is possible that these are not entirely detrimental from the standpoint of the storing up and destruction of thought material; to get hints regarding a reagent's fitness for a given vocation; in short, to make a diagnostic, prophylactic, and therapeutic study of the consciousness of a given individual.

In examining the work being done to-day along the line of mental tests my criticism has been that nearly everywhere it seems to end in the diagnosis, that is, the therapeutic significance of what is learned from the diagnosis is too much ignored. For this reason I have asked myself and have made some experiments to ascertain what the image method had to offer in a therapeutic

way. My preliminary experiments show that where persistent images are found, as in the various forms of hallucinations of normal persons, or persistent ideas as in the incipient forms of delusions, one can break them up and ultimately destroy them in some cases and in others substitute for them images and ideas having a more agreeable nature. The breaking down and destructive process was actually accomplished in cases of apparitions, accounts of which I have already published. I am now working upon experiments having to do not so much with the possibility of supplanting spontaneous images having a disturbing character by those that are more agreeable, for that I now know is possible, but more particularly with the various modes of bringing it about. I can already see that the photograph, stereopticon views, the moving picture and its accessories appealing to the other senses and the phonograph will be very useful in the building up and supplanting process just mentioned.

Before suggesting a new method of studying personality one naturally employs other methods to test and control his own. Biographical, autobiographical, historical, observational, introspective, etc., methods have actually been employed in the course of these experiments, in that the opinion that images are betrayers of personality is based, as has been said, upon the general agreement between what the images reveal regarding the observer and what others, including myself, know of him and of what he himself said regarding their revealing power.

It is everywhere evident that the more impersonal, systematic, and exact observation and introspection employed in the image method, give more reliable information regarding an individual than the chance and uncontrolled observation and introspection used in the methods just mentioned. Again, the observer's powers of discrimination in employing the image method are not called upon to the extent they would be if he was asked to make a series of judgments upon his own characteristics, since he was not informed until the experiments were completed as to the object of the investigation. What was learned by the image method was much more intimate and detailed than by the others. The experiments yielded not alone information agreeing with what was previously known of the observer by others and by myself, but what was not even known to the observers themselves until after the investigation had been made, that is, the images actually brought characteristic reactions to the observers' attention which they had not noticed before.

As it is in the association methods that one would expect to find the image method competitors, I determined to make some direct tests and asked each of the observers who took part in these experiments to write one hundred words in succession. The words written show that very much more can be learned through using the image method. The same thing was shown in applying the Kent-Rosanoff associative method.

It may be said in a general way regarding all the association methods, and among these I include the methods of psychoanalysis, that the image method gives results as regards personality that are far more definite and clear cut.

The experiments of Ach and Barrett along the lines of temperament and character mark an important step in experimental psychology, and it would be very interesting to compare results obtained by applying their methods and material with those obtained by the image method. However, the confining of character study largely to data having to do with choice,

and choice in connection with such very simple material as they used, is much too limited to give an adequate idea of an observer's personality, and for this reason, unless the experimental material were enormously increased and the method so modified as to introduce other mental activities than will, I am confident the use of this method also, as regards the image method, would be one of control and support and perhaps of supplementation. Taken all in all, it seems to me, the image method is more information bringing than any of other methods which have been proposed.

In the way of a general summary and conclusion it may be said that the results everywhere show that images are not isolated entities, but are closely bound together, supporting and supplementing each other as information-bearers and that for this reason one gets through taking them apparently at random, typical examples of the entire range of an individual's imagery. Since images are in general the "high-points" of *unanschaulich* thinking, one may also obtain from them a very complete idea of an individual's general manner of thinking and acting. Stated briefly, the experiments show that the image method is a mode of "sampling" which is adequate for a satisfactory diagnosis of a personality.

LILLIEN J. MARTIN

STANFORD UNIVERSITY

THE INDUSTRIAL FELLOWSHIPS OF THE MELLON INSTITUTE[1]

IT is again my privilege to report to SCIENCE progressive growth in both the number of industrial fellowships in operation and the amounts subscribed for their support. This makes evident the confidence which industrialists have in the Mellon Institute and the genuine value to industry of the industrial fellowship system.

The following table presents the number of industrial fellowships which have been established at the Mellon Institute from March to March of each year, 1911 to 1917; the number of researchers, or industrial fellows, who have been employed thereon, and the total amounts of money contributed for their maintenance by the industrial fellowship donors.

March to March	Number of Industrial Fellowships	Number of Industrial Fellows	Amounts Contributed
1911–1912..	11	24	$ 39,700
1912–1913..	16	30	54,300
1913–1914..	21	37	78,400
1914–1915..	21	32	61,200
1915–1916..	36	63	126,800
1916–1917..	42	64	147,000

As indicated in last year's report,[2] when the industrial fellowship system passed out of its experimental stage—when the Mellon Institute occupied its permanent home in February, 1915—twenty-three fellowships were in operation, while on March 1, 1916, there were thirty-six fellowships. It was mentioned in that report that the growth of the institute had about reached the stage where we should be obliged to decline further industrial investigations temporarily, since our laboratories were almost filled up to capacity. Notwithstanding that fact, the impetus imparted to the investigational activity in American chemical manufacturing, the direct result of the appreciation of urgent action in industrial research, induced us to arrange for the acceptance of six new fellowships during the institute year, March 1, 1916, to March 1, 1917. At the present time (March 1, 1917) there are forty-two fellowships and four additional ones have recently been arranged for, to begin later in the year.

[1] For previous reports on the status of the system of cooperation between science and industry in operation at the Mellon Institute, see Duncan, SCIENCE, N. S., Vol. XXXIX. (1914), 672; and Bacon, *ibid.*, XLIII. (1916), 453.

[2] SCIENCE, N. S., Vol. XLIII. (1916), 453.

A LIST OF THE INDUSTRIAL FELLOWSHIPS IN OPERATION AT THE MELLON INSTITUTE ON MARCH 1, 1917

Numbers and Names of Industrial Fellowships in Operation	Industrial Fellows, Names and Degrees	Foundation Sums and Dates of Expiration
No. 28. *Fertilizer*	H. H. Meyers (B.S., University of Pennsylvania).	$2,500 a year for 1 year. Bonus: $5,000. January 5, 1918.
No. 48. *Bread*	*H. A. Kohman* (Ph.D., University of Kansas), Senior Fellow. T. M. Godfrey (B.S., University of Kansas). L. H. Ashe (B.S., University of Pittsburgh).	$6,500 a year for 2 years. Bonus: $10,000. March 1, 1917.
No. 51. *Yeast*	*Ruth Glasgow* (M.S., University of Illinois). T. A. Frazier (Chem.B., University of Pittsburgh).	$3,150 a year for 2 years. September 1, 1917.
No. 61. *Synthetic organic products*	*C. S. Palmer* (Ph.D., Johns Hopkins University), Senior Fellow. W. J. Harper (A.B., Ohio University). E. W. Reid (A.B., Southwestern College).	$6,000 a year for 2 years. Bonus: $3,500. November 10, 1917.
No. 63. *Canning*	E. H. Taylor (M.S., University of Illinois).	$1,200 a year for 1 year. November 1, 1917.
No. 67. *Bottle glass*	J. F. W. Schulze (Ph.D., Clark University).	$2,400 a year for 1 year. September 1, 1917.
No. 68. *Illuminating glass*	A. H. Stewart (A.B., Washington and Jefferson College).	$900 a year for 2 years. October 1, 1917.
No. 74. *Dental products*	C. C. Vogt (Ph. D., Ohio State University).	$2,300 a year for 1 year. July 1, 1917.
No. 76. *Glue and soap*	F. O. Amon (Sc.D., New York University). B. H. Nicolet (Ph.D., Yale University), Advisory Fellow.	$4,000 a year for 1 year. December 20, 1917.
No. 77. *Food container*	C. L. Weirich (M.S., University of Pittsburgh).	$1,800 a year for 1 year. Bonus: $6,000. March 31, 1917.
No. 78. *Iron ore*	F. M. McClenahan (M.A., Yale University).	$3,000 a year for 1 year. June 15, 1917.
No. 79. *Sand*	S. C. Ells (B.Sc., McGill University).	$5,000 a year for 1 year. June 1, 1917.
No. 82. *Medicinal products*	O. F. Hedenburg (Ph.D., University of Chicago).	$2,500 a year for 1 year. Bonus: 1 per cent. of profit for 5 years. June 14, 1917.
No. 84. *Copper*	H. P. Corliss (Ph.D., University of Pittsburgh). C. L. Perkins (B.S., New Hampshire College).	$5,400 a year for 1 year. July 1, 1917.
No. 85. *Copper*	E. D. Wilson (Ph.D., University of Chicago). A. S. Crossfield (B.S., University of California).	$3,600 a year for 1 year. July 1, 1917.
No. 86. *Pharmaceutical products*	*J. B. Churchill* (M.S., Pennsylvania State College), Senior Fellow. C. J. Herrly (B.S., Pennsylvania State College).	$4,600 a year for 1 year. July 7, 1917.
No. 87. *Washer waste*	C. B. Carter (Ph.D., University of North Carolina).	$2,500 a year for 1 year. August 7, 1917.
No. 88. *Soda*	C. W. Clark (Ph.D., University of Pittsburgh).	$3,000 a year for 1 year. September 1, 1917.
No. 89. *Organic synthesis*	H. A. Morton (Ph.D., University of Pittsburgh). H. J. Little (B.S., Delaware College).	$3,600 a year for 1 year. Bonus: $5,000. July 1, 1917.

(*Continued*)

Numbers and Names of Industrial Fellowships in Operation	Industrial Fellows, Names and Degrees	Foundation Sums and Dates of Expiration
No. 90. *Gas*	*J. B. Garner* (Ph.D., University of Chicago), Senior Fellow. F. W. Padgett (M.S., University of Pittsburgh). C. A. Neusbaum (A.B., Wabash College). D. F. Zimmers (B.S., University of Pittsburgh), Scholar.	$9,420 a year for 1 year. September 15, 1917.
No. 91. *Coke*	*F. W. Sperr, Jr.* (B.A., Ohio State University), Advisory Fellow. Marc Darrin (M.S., University of Washington). A. A. Kohr (B.S., Ohio State University). R. J. Montgomery (Cer. Eng., Ohio State University).	$5,640 a year for 1 year. January 1, 1918.
No. 93. *Collars*	H. D. Clayton (B.A., Ohio State University).	$2,300 a year for 1 year. October 1, 1917.
No. 94. *Coffee*	C. W. Trigg (B.S., University of Pittsburgh).	$1,500 a year for 1 year. Bonus: 2 per cent. of gross receipts. October 1, 1917.
No. 95. *Magnesia*	G. F. Gray (M.E. in E.E., Ohio State University).	$3,500 a year for 1 year. November 1, 1917.
No. 96. *Machinery*	Rudolph McDermet (E.E., University of Illinois).	$2,000 a year for 1 year. September 1, 1917.
No. 97. *Oil*	*B. T. Brooks* (Ph.D., University of Göttingen), Senior Fellow. Harry Essex (Ph.D., University of Göttingen). I. W. Humphrey (M.S., University of Kansas). D. F. Smith (M.S., University of Wisconsin).	$10,000 a year for 1 year. Bonus: $10,000. September 1, 1917.
No. 98. *Paints*	J. V. Thompson (A.B., Cornell University). C. E. Ruby (B.S., University of Kentucky).	$2,100 a year for 1 year. September 1, 1917.
No. 99. *Glyceryl phosphates*	F. F. Rupert (Ph.D., Massachusetts Institute of Technology).	$1,500 a year for 1 year. Bonus: 10 per cent. of profits. October 1, 1917.
No. 100. *Fiber*	C. E. Howson (B.S., Ohio State University).	$2,500 a year for 1 year. November 13, 1917.
No. 101. *Milling*	H. C. Holden (M.S., New Hampshire College).	$2,500 a year for 1 year. October 18, 1917.
No. 102. *Fruit juice*	R. R. Shively (Ph.D., University of Pittsburgh).	$5,000 a year for 1 year. October 1, 1917.
No. 103. *By-products recovery.*	Walther Riddle (Ph.D., University of Heidelberg).	$3,000 a year for 1 year. January 1, 1918.
No. 104. *Copper*	*G. A. Bragg* (B.S., University of Kansas), Senior Fellow of all *Copper* Fellowships. J. D. Malcolmson (B.S., University of Kansas).	$6,500 a year for 1 year. November 1, 1917.
No. 105. *Illumination*	*G. O. Curme, Jr.* (Ph.D., University of Chicago), Senior Fellow. G. D. Bagley (M.S. in E.E., University of Illinois). H. R. Curme (B.S., Northwestern University). C. N. Iry (B.S., Purdue University).	$8,000 a year for 1 year. Bonus: $5,000. November 15, 1917.

(*Concluded*)

Numbers and Names of Industrial Fellowships in Operation	Industrial Fellows, Names and Degrees	Foundation Sums and Dates of Expiration
No. 106. *Silverware*	H. E. Peck (B.S., Clarkson Memorial College of Technology).	$2,000 a year for 1 year. December 11, 1917.
No. 107. *Cottonseed*	F. W. Stockton (A.B., University of Kansas).	$3,600 a year for 1 year. Bonus: $5,000. October 16, 1917.
No. 108. *Insecticides*	C. O. Brown (M.A., Cornell University).	$3,000 a year for 1 year. January 1, 1918.
No. 109. *Glass refractories*	A. E. Blake (M.S., University of Pittsburgh).	$2,300 a year for 1 year. November 1, 1917.
No. 110. *Toilet articles*	L. M. Liddle (Ph.D., Yale University).	$3,000 a year for 1 year. December 1, 1917.
No. 111. *Distillation*	David Drogin (B.A., College of the City of New York).	$1,800 a year for 1 year. January 18, 1918.
No. 112. *Laundering*	H. G. Elledge (M.S., University of Pittsburgh).	$2,500 a year for 1 year. February 15, 1918.
No. 113. *Flavoring*	W. E. Vawter (B.S., University of Kansas).	$1,800 a year for 1 year. Bonus: $2,000. February 1, 1918.
Special research work.	E. O. Rhodes (M.S., University of Kansas) and R. W. Miller (M. S., Kansas State College).	

SUBJECT LIST OF INDUSTRIAL FELLOWSHIPS FROM THE INAUGURATION OF THE SYSTEM TO THE PRESENT TIME

University of Kansas, 1907–1911[3]

K–1. Laundering. K–2. Alfalfa. K–3. Salt-rising Bread. K–4. Casein. K–5. Oil. K–6. Enamel. K–7. Glass. K–8. Cement. K–9. Varnish. K–10. Borax. K–11. Adrenaline. K–12. Vegetable Ivory. K–13. Oil. K–14. Gilsonite. K–15. Fats. K–16. Leather. K–17. Copper. K–18. Copper (continuation of K–17).

University of Pittsburgh, 1911 to date

1. Bread. 2. Smoke. 3. Glass. 4. Bread. 5. Glue. 6. Soap. 7. Fruit Juice. 8. Composition Flooring. 9. Oil. 10. Gas. 11. Cement. 12. Foods. 13. Fatty Oils. 14. Electricity. 15. Coated Steel. 16. Copper (continuation of K–18). 17. Desert Plant. 18. Bread (continuation of 4). 19. Aluminum. 20. Glue (continuation of 5). 21. Soap (continuation of 6). 22. Glass. 23. Electricity (continuation of 14). 24. Copper (continuation of 16). 25. Yeast. 26. Fats (continuation of K–15). 27. Leather Waste (continuation of K–16). 28. Fertilizer. 29. Copper (continuation of 24). 30. Radiators. 31. Machinery. 32. Glass. 33. Copper (continuation of 29). 34. Fatty Oils (continuation of 13). 35. Copper (continuation of 33). 36. Copper. 37. Illumination. 38. Dental Products. 39. Compound Fats. 40. Stone. 41. Copper (continuation of 35). 42. Bottle Glass. 43. Laundering. 44. Land Development. 45. Copper (continuation of 35). 46. Organic Synthesis. 47. Soda. 48. Bread (continuation of 18). 49. Candy. 50. Paints. 51. Yeast (continuation of 25). 52. Copper (continuation of 36).

[3] The system of industrial research founded by

Subject List of Industrial Fellowships from the Inauguration of the System to the Present Time (continued)

53. Copper (continuation of 45). 54. Dental Products (continuation of 38). 55. Pharmaceutical Products. 56. Soap (continuation of 21). 57. Glue (continuation of 20). 58. Machinery (continuation of 31). 59. Milling. 60. Collars. 61. Inorganic Synthetic Products. 62. Gas. 63. Canning. 64. Oil (continuation of 9). 65. Compound Fats (continuation of 39). 66. Glyceryl Phosphates. 67. Bottle Glass (continuation of 42). 68. Glass (continuation of 22). 69. Linoleum. 70. Gum. 71. Stoves. 72. Copper (continuation of 53). 73. Illumination (continuation of 37). 74. Dental Products (continuation of 54). 75. Flavoring Materials. 76. Glue and Soap (continuation of 56 and 57). 77. Food Container. 78. Iron Ore. 79. Sand. 80. Laundering (continuation of 43). 81. Varnish. 82. Medicinal Products. 83. Cannel Coal. 84. Copper (continuation

of 52). 85. Copper (continuation of 72). 86. Pharmaceutical Products (continuation of 55). 87. Washer Waste. 88. Soda (continuation of 47). 90. Gas (continuation of 62). 91. Coke. 92. Leather Belting. 93. Collars (continuation of 60). 94. Coffee. 95. Magnesia. 96. Machinery (continuation of 58). 97. Oil (continuation of 64). 98. Paints (continuation of 50). 99. Glyceryl Phosphates (continuation of 66). 100. Fiber. 101. Milling (continuation of 59). 102. Fruit Juice. 103. By-products Recovery. 104. Copper (continuation of 85). 105. Illumination (continuation of 73). 106. Silverware. 107. Cottonseed. 108. Insecticides. 109. Refractories (Glass). 110. Toilet Articles. 111. Distillation. 112. Laundering (continuation of 80). 113. Flavoring (continuation of 75). 114. Enameling. 115. Bread (continuation of 48).

The Mellon Institute is now active in promoting the progress of science and in stimulating further inquiry by making available to the workers in pure and applied science complete and detailed reports of researches conducted under its auspices;[4] it maintains an attitude of welcome towards prospective industrial research organization[5] and has established stable cooperative relations with other research laboratories; and it is continuing its policy of educating the public to the realizable functions of research.[6] While effectively combatting pseudo-research in industry by reducing the cost of systematic investigation to a minimum, the Mellon Institute has been able to demonstrate to industrialists that, under favorable conditions, numerous manufacturing problems can be advantageously studied outside of plant laboratories. This has resulted in the extension of the practise of referring certain of the problems of industry to university laboratories for study.[7] However, this cooperative relation must be stabilized and promoted by the demonstration of its advantages by the institutional laboratories involved. About seventy per cent. of the problems assigned to the Mellon Institute for study during the five years, March, 1911, to March, 1916, were solved to the satisfaction of the donors, and like results can undoubtedly be obtained by similarly well-founded establishments. On every side the research men of our universities are needed for the execution of real attainment in the technical world with its difficulties, wastes and unexplored lines of manufacturing.

The administration of the Mellon Institute is now constituted as follows:

Raymond F. Bacon, Ph.D., Director;
Edward R. Weidlein, M.A., Associate Director;
Samuel R. Scholes, Ph.D., Assistant Director;
E. Ward Tillotson, Jr., Ph.D., Assistant Director;
John J. O'Connor, Jr., M.A., Assistant Director;
Martin A. Rosanoff, Sc.D., Head of the Department of Research in Pure Chemistry.

R. F. BACON

PITTSBURGH, PA.,
March 1, 1917

[4] Twenty-two journal contributions were made during the past Institute year. For a list of the scientific papers published by the Institute from 1911–1914, see Bacon, *J. Frankl. Inst.*, November, 1914, 629–32. Eighteen journal articles were published by the Institute during 1914–1915 (Sparks and Noyes, SCIENCE, N. S., Vol. XLV. (1917), 169).

[5] The following institutions have entered the field of industrial research: the universities of Kansas, Washington, Toronto and Akron, the Georgia School of Technology and the University of Finland (Helsingfors, Finland). The establishment of industrial fellowships in accordance with the practical system in operation at the Mellon Institute, is being considered by Massachusetts Agricultural College, Harvard University, Washington State College, McGill University, University of Sheffield (England), Sir John Cass Technical Institute (London), Sydney University (New South Wales, Australia), and University of Tokyo (Japan).

[6] See, in this connection, Bacon, SCIENCE, N. S., Vol. XLV. (1917), 34.

[7] For detailed presentments of the present-day technochemical problems which could be referred to university laboratories for investigation, see Bacon, *J. Ind. Eng. Chem.*, 7 (1915), 535; and *J. Soc. Chem. Ind.*, 36 (1917), 9.

SCIENTIFIC EVENTS

GRANTS FOR SCIENTIFIC AND INDUSTRIAL RESEARCH IN ENGLAND

WHEN the establishment of a separate department of scientific and industrial research was announced in December last, Lord Crewe

stated that the chancellor of the exchequer was prepared to advise the government to devote a sufficient sum to cover operations during the next five years on a scale which would provide four, or perhaps five, times as much for cooperative industrial research as had been spent for the whole purposes of research hitherto. According to *Nature* the civil service estimates just issued include the sum of £1,038,050 to the Department of Scientific and Industrial Research, being a net increase of £998,050 upon last year's amount. Grants for investigations carried out by learned and scientific societies, etc., are estimated at £24,000, and grants to students and other persons engaged in research at £6,000. These grants will be distributed by a committee of the Privy Council, on the recommendation of the Advisory Council, to promote the development of scientific and industrial research in the United Kingdom, and will be subject to such conditions as the committee may think necessary. The £1,000,000 grant in aid of industrial research will be paid to the account of the Imperial Trust for the encouragement of scientific and industrial research. The expenditure of the trust will be audited by the comptroller and auditor-general, but any balance remaining on the account will not be surrendered at the close of the financial year. Grants will be made by the directions of the committee of the Privy Council over an agreed period to approved trade associations for research, to supplement the funds of the associations, and payments in respect of such grants will not be liable to surrender by the grantees at the end of the financial year. It is understood from Lord Crewe's remarks on December 1 that for the next five years or so about £200,000 a year would be available for scientific and industrial research, so that apparently the grant of £1,000,000 is the sum which is to be drawn upon for this purpose. The amount estimated for salaries, wages and allowances in the new department is £7,250, which includes £1,500 for the secretary and £850 for the assistant secretary. Traveling and incidental expenses are estimated to amount to £800.

THE GENERAL MEDICAL BOARD OF THE COUNCIL OF NATIONAL DEFENSE

A general medical board of the Council of National Defense was organized on April 17 at a meeting attended by leading physicians from all parts of the country. The board is to have general supervision of the mobilization of the nation's medical resources during the war. Dr. Franklin Martin, of Chicago, will be chairman of the board, which will also include the leading members of the executive committee of the board, announced a short time ago. The list follows:

Dr. Franklin Martin, chairman.
Dr. F. F. Simpson, vice-chairman.
Surgeon General William C. Gorgas, United States Army.
Surgeon General William C. Braisted, United States Navy.
Surgeon General Rupert Blue, United States Public Health Service.
Colonel Jefferson R. Kean, director of military relief, American Red Cross.
Dr. William H. Welch, professor of pathology, Johns Hopkins University.
Dr. William J. Mayo, Rochester, Minn.
Dr. Edward Martin, professor of surgery, University of Pennsylvania.
Dr. Victor C. Vaughan, dean of the medical school of the University of Michigan.
Dr. George H. Simmons, editor, *Journal of American Medical Association*, Chicago.
Dr. Richard P. Strong, professor of tropical medicine, Harvard University.
Dr. Joseph M. Flint, professor of surgery, Yale University.
Dr. Stuart McGuire, professor of surgery, University of Virginia.
Dr. John Young Brown, professor of surgery, University of St. Louis.
Dr. Charles H. Mayo, Rochester, Minn.
Dr. Thomas W. Huntington, professor of surgery, University of California.
Dr. Hubert A. Royster, secretary of Southern Surgical Association.
Dr. Charles H. Peck, professor of surgery, Columbia University.
Dr. Winford Smith, superintendent, Johns Hopkins Hospital.
Dr. Frederic A. Besley, professor of surgery, Northwestern University.
Dr. George W. Crile, professor of surgery, Western Reserve University.

Earl Phelps, sanitary engineer, Washington, D. C.
Dr. John M. Finney, professor of clinical surgery, Johns Hopkins University.
Dr. Edward P. Davis, professor of obstetrics, Jefferson Medical College.
Dr. Edward C. Kirk, dean of dental department, University of Pennsylvania.
Dr. W. C. Woodward, commissioner of Public Health, Washington, D. C.
Dr. Simon Flexner, director, Rockefeller Institute, New York City.
Dr. Theodore Janeway, professor of medicine, Johns Hopkins University.
Dr. Hermann M. Biggs, New York Commissioner of Public Health.
Dr. George Brewer, professor of surgery, Columbia University.
Dr. George Walker, Johns Hopkins University.

SCIENTIFIC NOTES AND NEWS

AT the meeting of the National Academy of Sciences in Washington on April 18, the following members were elected: Edward Kasner, mathematics; Walter S. Adams, astronomy; Theodore Lyman, Walter C. Sabine, S. W. Stratton, physics; W. R. Whitney, chemistry; J. J. Carty, electrical engineering; W. F. Durand, marine engineering; H. M. Howe, metallurgy; E. O. Ulrich, geology; Robert Ridgway, ornithology; Harvey Cushing, William S. Halsted, surgery; L. H. Bailey, botany; Edward L. Thorndike, psychology.

AT the annual dinner of the National Academy of Sciences on the evening of April 17, the Henry Draper gold medal was presented to Professor A. A. Michelson, of the University of Chicago, and the public welfare medal to Dr. S. W. Stratton, director of the Bureau of Standards.

THE seventh annual award of the Willard Gibbs Medal, founded by William A. Converse of Chicago, will be made to Dr. Edward W. Morley. Dr. Morley was elected by a jury of twelve, including some of our most eminent chemists in the United States. He will talk upon his early work in connection with hydrogen and oxygen, on Friday evening, May 18, at Hotel Sherman, Chicago, at which meeting the medal will be awarded to him. Previous recipients of this medal have been: W. R. Whitney, A. A. Noyes, T. W. Richards, Ira Remsen, L. H. Baekeland and Svante Arrhenius.

PROFESSOR M. C. WHITAKER, head of the department of chemical engineering, Columbia University, was elected vice-president of the U. S. Industrial Alcohol Co., at the meeting of their board, on April 19. In this capacity, Mr. Whitaker will serve as chairman of the manufacturing committee in charge of plants and operations, chairman of the research committee in charge of the new laboratories at Baltimore, and as a member of the sales committee of the company.

DR. H. N. MCCOY, who has been connected with the department of chemistry of the University of Chicago since 1901 and professor since 1911, has tendered his resignation in order to be free to devote more time to his important technical interests. His process of extracting radium from carnotite is being used by the Carnotite Production Company of Chicago in which he is a director. He is also interested in the production of thorium and related products and is a director of the Lindsay Light Company of Chicago, which has probably the largest thorium production in the country.

ANOUNCEMENT is made by the Forest Service of the appointment of Carlile P. Winslow as director of the Forest Products Laboratory, at Madison, Wisconsin, to succeed Howard F. Weiss, whose resignation took place on April 1.

DOROTHY W. BLOCK has been awarded the Maria Mitchell memorial scholarship of $500, to be used in research work at the Harvard observatory during the year 1917–18. For the past two years Miss Block has been laboratory assistant in the department of astronomy at Hunter College.

JAMES F. COUCH was elected president of the recently organized Des Moines Chemical Society at the regular meeting on April 9.

A GRADUATE medical course will be conducted at the new St. Luke's Hospital, Spokane, during the summer. Among those who have accepted invitations to lecture, according to the *Journal* of the American Med-

ical Association, are: Drs. W. T. Councilman, Harvey Cushing, Walter B. Cannon, Fritz B. Talbot, James S. Stone, George Holmes, David L. Edsall and Francis W. Peabody, Boston; William G. MacCallum and Warfield T. Longcope, New York; Lewellys F. Barker and Theodore C. Janeway, Baltimore, and Rollin T. Woodyatt, Ludvig Hektoen and Harry G. Wells, Chicago.

The advisory commission of the Council of National Defense and the National Research Council have sent six American men of science to England and France to study problems arising out of the war. Members of the party and the subjects in which they will specialize are: Dr. Joseph S. Ames, Johns Hopkins University, aeronautical conditions; Dr. Richard P. Strong, Harvard University, camp sanitation; Dr. Linsley R. Williams, assistant health commissioner of New York State; George A. Hulett, Princeton University, chemistry of explosives; Dr. Harry Fielding Reid, Johns Hopkins University, scientific map making and photography from airplanes, and Dr. George R. Burgess, of the Federal Bureau of Standards, metals suitable for guns and rigid dirigibles. The party is accredited to the American Embassies in London and Paris.

Six professors of the University of Minnesota have been asked by the war department to act as a scientific research board for the district of the state of Minnesota. The duties asked of them will require a considerable portion of their time from now on. These men are Professor John J. Flather, head of the department of mechanical engineering, Dean George B. Frankforter of the school of chemistry, Dr. L. G. Rowntree, head of the department of medicine, Professor R. W. Thatcher, head of the department of agricultural chemistry, L. W. McKeehan of the department of physics, F. R. McMillan, of the department of structural engineering. Dean Frankforter and Professor Flather acted upon a special navy board which made an inventory of Minnesota resources last summer and the figures which they gathered at that time will be of inestimable value in the present crisis.

At the annual dinner and initiatory exercises of the Washington University chapter of Sigma Xi, the president of the chapter, Dr. B. M. Duggar, discussed "Some Materials and Problems in Plant Pathology."

Dr. Charles Baskerville, director of chemical laboratories of the College of the City of New York, delivered an illustrated address at the Franklin Institute, Philadelphia, on April 19, his subject being "The Hydrogenation of Oils."

At the recent meeting of the West Virginia Scientific Society Dr. Ludvig Hektoen, of the University of Chicago, delivered an address on "Recent Investigations of Infantile Paralysis."

Mr. William Bowie, chief of the division of geodesy, delivered recently an address before the Geological Society of Washington, D. C., on "Some Evidences of Isostasy."

Dr. R. A. Pearson, president of the Iowa State College, has been made chairman of a committee which will include one member from each congressional district of the state of Iowa and whose duty will be to organize the farmers of the state in the interest of food conservation and increased production. The creation of such a committee was recommended by a conference of the leading men of the state held at the state house on April 3 at the call of Governor Harding. The governor will appoint the other members of the committee. The conference recommended an emergency appropriation by the legislature of $100,000 for 1917 and an equal amount for 1918 to be used under the supervision of the extension department of the Iowa State College in a campaign to increase the food production of Iowa.

Professor A. D. Wilson, director of agricultural extension work of the University of Minnesota, has been appointed by the government to direct the work of farm production and labor conservation in the northwest during the continuance of the war.

Professor Joseph Jastrow, of the University of Wisconsin, is giving a series of lectures

at the Ohio State University on "Sources of Human Nature."

HERBERT WILLIAM CONN, professor of biology in Wesleyan University and Connecticut State bacteriologist, has died at the age of fifty-eight years.

THE death is announced of Emil von Behring, professor in the University of Marburg, discoverer of diphtheria antitoxin. He was born in West Prussia in 1854. In 1901 he received the Nobed prize in medicine, and was made a member of the hereditary nobility.

THE death is announced of Dr. Narcisse E. Dionne, librarian of the Legislature of Quebec, and formerly professor of archeology of Laval University. Dr. Dionne was the author of a number of important biographical and historical works, and in 1907 served as general secretary of the fifteenth International Congress of Americanists, which was held at Quebec.

THE Southern Society for Philosophy and Psychology held its twelfth annual meeting on April 12 and 13, 1917, at Randolph-Macon Woman's College, Lynchburg, Va. It was voted to extend the scope of the society so as to include "experimental education," and to hold the next meeting at Peabody College for Teachers, Nashville, Tenn. The following officers were elected: President, Professor E. K. Strong, Jr., Peabody College, Nashville; Vice-president, Dr. T. V. Moore, Catholic University of America, Washington, D. C., and Secretary-Treasurer, Professor W. H. Chase, University of North Carolina. The newly elected members of the council are: Dr. Tom A. Williams, Washington, D. C., Professor E. B. Crooks, Randolph-Macon, Lynchburg, Va., and Professor Knight Dunlap, of Johns Hopkins University.

AT the annual meeting of the American Association of Immunologists, held in New York, April 6 and 7, Dr. John A Kolmer, Philadelphia, was elected president; Dr. Martin J. Synnott, Montclair, N. J., secretary, and Dr. Willard J. Stone, Toledo, Ohio, treasurer. The new council is composed of the officers and Drs. Richard Weil, Arthur F. Coca and William H. Park, New York, and Dr. A. Parker Hitchens, Glen Olden, Pa. The next meeting will be held in Minneapolis in April, 1918.

A SCIENCE Faculty Club has been organized at the University of Southern California, Los Angeles, Calif. The purpose of the club is to promote research and cooperation between the departments of science in the university. A meeting is held each month. The officers are Professor Albert B. Ulrey, president; Professor Arthur W. Nye, vice-president, and Miss Catherine V. Beers, secretary.

THE Oklahoma State Bureau of Standards, which was organized by act of the legislature of 1915 secured an appropriation of $8,500 with which to purchase equipment. It is the purpose of the bureau to secure primary and secondary standards of weights and measures and for testing gas, water and electric meters. The bureau is also planning the equipment of a laboratory for the measuring and testing of the best values of fuels as coal and petroleum products. The bureau is situated at the State University and with the equipment planned will be able to provide the people of the state a place where they may have their weights and meters, etc., calibrated.

UNIVERSITY AND EDUCATIONAL NEWS

THE president of the Republic of Panama has signed a decree establishing a Pan-American University in accordance with a law passed by the legislature on January 27. The trustees are to consist of the secretary of public instruction of Panama and the diplomatic representatives of the American republics or their representatives. Diplomatic representatives of other countries maintaining chairs in the university are also to have representatives on the board. It is believed that the university may be of international value to the American republics, especially in subjects such as medicine, law and agriculture.

THE legislature of the state of Oklahoma at its recent session made provision for the following buildings for the State University at Norman: Auditorium, $150,000; wing to library, $75,000; geology building, $100,000; hospital at Oklahoma City in connection with

the medical school, $200,000. At the same time the Agricultural and Mechanical Arts College at Stillwater was granted: Science hall, $100,000; gymnasium, $100,000.

The residue of the estate of James Buchanan Brady, which is estimated as more than four million dollars, is bequeathed to the New York Hospital on West Sixteenth Street, New York City, to establish the James Buchanan Brady Foundation for a urological institute, similar to that at Johns Hopkins Hospital at Baltimore, which Mr. Brady had endowed during his life with $200,000. An additional $300,000 is left in trust to the Johns Hopkins Hospital for the maintenance of the institute.

The Harvard Medical School will provide instruction for the senior class during the summer, with two weeks holiday. It is optional with students whether they will begin their fourth year's work on June 4 or September 24.

Owing to the national emergency, the Cornell University Medical College announces that it will continue instruction for members of its senior class throughout the summer so that they may be graduated with the degree of M.D. on or about January 1, 1917.

Professor C. R. Richards, professor of mechanical engineering and head of the department since 1911, has been appointed dean of the College of Engineering and director of the Engineering Experiment Station of the University of Illinois to succeed Dr. W. F. M. Goss who has resigned to become president of the Railway Car Manufacturers' Association of New York.

Dr. Chas. Brookover, of the University of Kansas, has been elected professor of anatomy and director of the department at the University of Louisville.

DISCUSSION AND CORRESPONDENCE

A VIABLE TEN-YEAR-OLD CULTURE OF BACILLUS PARATYPHOSUS BETA

As the usual text-books, manuals and current literature make but little or no mention of the length of life of individual bacteria the following record may not be without interest.

In 1909, when I began teaching bacteriology at Howard University, among the stock cultures of organisms in the laboratory was one labeled "Paratyphoid Schottmüller 1–14–06." It was a deep agar stab made in a narrow test tube and the tube instead of being closed in the usual manner by a cotton plug had been sealed off in the flame. Hermetically sealed, the agar culture had been prevented from drying. The culture had been prepared three years previously by Dr. W. W. Alleger.

On January 17, 1916, ten years and three days after the culture had been made, the tube was broken open and the organisms transferred to Russell double sugar. The characteristic red color and gas did not appear in the butt of the tube on the first transfer. Transfers were then made from this tube to other double sugar tubes at irregular intervals during a couple of months. At about the fifth transfer the organism showed its characteristic reaction on the double sugar. Its fermentation of separate sugars was tried, as well as other cultural tests, and the agglutination test with paratyphoid beta immune serum was done. All these indicated that the organism was *Bacillus paratyphosus beta.*

During the ten years it had always been kept in a closet away from the light, along with the other stock cultures. The temperature in closet varied during the first five years from as high as 32° C. in summer to nearly as low as 0° C. in winter. During the last five years the temperature was never lower than 15° C.

M. W. Lyon, Jr.

George Washington University

A METHOD FOR KILLING TURTLES

Killing turtles for class purposes is more or less of a task depending upon the equipment at hand. Even though a closed tank is available for administering gas, thirty minutes to an hour is required for anesthetizing these reptiles and then they may revive during dissection. Another expedient sometimes resorted to is to place the specimens in boiling water for a few minutes. This has its objections. I have observed attempts to

give an anesthetic or a poison by way of the mouth which is almost impossible. However, substances can be introduced into the alimentary tract through the anus and the desired results obtained.

Such is the method used in this laboratory. Chloroform is injected into the cloaca and a string tied in front of the anus to prevent the ejection of the liquid. Five c.c. of chloroform thus given will anesthetize an eight-inch turtle sufficiently for dissection in thirty to forty-five minutes.

The value of this method is threefold. First, a string and a pipette constitute the necessary equipment; second, the ease with which the anesthetic can be given is evident; and third, there is no danger of the specimens coming out from under the chloroform.

NEWTON MILLER
UNIVERSITY OF UTAH

SCIENTIFIC BOOKS

Combinatory Analysis. By MAJOR PERCY A. MACMAHON. Cambridge University Press. 1915, Vol. 1, xix + 300 pp., and 1916, Vol. 2, ix + 340 pp.

One of the four grand divisions of what may be called properly static mathematics is the theory of configurations. It includes the construction out of given elements of compound forms under certain given conditions or restrictions; together with the characters possessed by such constructions when they are varied under given laws, such as, for instance, the character of transitivity, or that of primitivity; and the laws of dependence of such constructions upon each other; as well as finally the invention of new or ideal elements of mathematics that enable the solution of problems of construction to be effected. These constructions vary from the mere permutation of a linear series of elements up to the complicated trees of chemical combinations studied by Cayley, and in general to all sorts of problems in what has been happily denominated tactics by Cayley, or syntactics by Cournot. We find in its field the construction of magic squares, of Latin squares, of Latin-Greek squares, of triangles, stars, polygons, chess problems, routes over net works, problems of topography, and without much stretch of imagination we might now include the disposition of the elements of war. The field is obviously large in extent, and in a wide variety of aspects fascinating. From certain points of view one might be tempted to conclude that we could include in it all mathematics, for the definition given by C. S. Peirce made mathematics the science of ideal constructions and their applicability to the world as it is.

The study of configurations usually begins with combinatory analysis. By this is usually meant the study of the arrangements along a line of a collection of objects, either as individuals or in groups; arrangements at the nodes of a lattice; combinations of arrangements. Such problems arise not only as matters of tactic, curious problems or puzzles, but in the determination of the number of such arrangements needed in solving problems in the theory of probabilities.

The treatise of Professor MacMahon undertakes to present some very general methods of handling such studies. These methods consist for a large part in the construction of enumerating generating functions, and involve considerable study of symmetric functions and certain differentiating operators. In the course of this study he arrives at some very elegant theorems. These methods not only enumerate the possible forms, but in many cases afford methods of actual construction of the entire list of such possible forms. They are very powerful and have enabled the author to solve problems that were considered for a long time to be beyond the reach of mathematical analysis. His success and presentation in complete form may induce others to study this important branch of mathematics.

There are eleven sections, and the topics under consideration will give some idea of the character of the treatise. Section one considers ordinary symmetric functions and their connection with the theory of distribution of objects into parcels. The operators which are useful for these purposes are developed, and their algebra considered, turning out to be quite analogous to the algebra of symmetric

functions. A distinction is drawn between the parcel of objects, in which the order of arrangement in the parcel is immaterial, and the group of objects, in which the order of arrangement in the group is material. For instance if we sort 3 α's 2 β's, 1 γ, 1 δ into seven boxes of which four boxes are exactly alike, and three boxes alike but different from the first four, we find that we have a problem of distribution of objects of type (321^2) into parcels of type (43), which can be done in 11 ways. This number 11 may be found by a distribution function, derived from the theory of symmetric functions. This function gives, for instance, for the various types of 4 objects distributed into parcels of type (2) these results: for type (4), 2 ways, for type (31) 3 ways, for type (22) 4 ways, for type (211) 5 ways, for type (1111) 7 ways. If, however, the distribution is into groups rather than into parcels, we have for type (4) 2 ways, for type (31) 6 ways, for type (22) 10 ways, for type (211) 18 ways, and for type (1111) 36 ways. The determination by the function consists in finding the coefficients in formulæ that arise from the theory of symmetric functions. These coefficients may be found directly for the individual terms by using the operators referred to.

Section two considers the theory of separations, a separation being a distribution of the numbers constituting a partition of some integer into parcels, or groups. Extensive generalizations are possible from the formulæ and the operators produced. The application to sets of objects of given types and their distributions resolves more complicated problems than those given before. For instance, with a set of four threefold objects, $a_1a_2a_3$, $a_1a_2a_3$, $b_1b_2b_3$, $c_1b_2c_3$ can be formed 38 cases of distribution into the types (211), (22), (211), namely the objects $a_1a_1b_1c_1$, $a_2a_2b_2b_2$, $a_3a_3b_3c_3$, and the different permutations of these arrangements.

Section three deals with permutations, particularly with points useful in the general theory of combinations and distributions. A certain master theorem is deduced which has great resolving power. In particular it solves the problem of ascertaining the number of permutations in which every letter occupies a new place, and in expressing sums of powers of binomial coefficients. The notion of lattice permutation is introduced, by which is meant that if any permutation be made of a a's, b β's, c γ's, etc., to be a lattice permutation it must be such that reading it from left to right, at no point of it will the number of a's so far written be less than the number of β's, nor number of β's less than the number of γ's, etc. For instance, for 2 a's and 2 β's the lattice permutations are $aa\beta\beta$, and $a\beta a\beta$. The permutation $a\beta\beta a$ is not a lattice permutation because when we arrive at the third letter, we shall have 2 β's and only 1 a. These are called lattice permutations because they serve to handle arrangements of integers at the nodes of a rectangular lattice in a plane, or in space.

Section four considers compositions of integers, by which is meant the permutations of the partitions of the integer. In connection with these some new symmetric functions are introduced. An application to Newcomb's problem is made. It is this: given p cards marked 1, q marked 2, r marked 3, etc., which are shuffled and dealt in such wise, that as long as a card is not of lower number than the preceding it is placed upon the preceding, but if lower it must start a new pile; what is the probability that there are at most m piles when all have been dealt?

Section five introduces the notion of perfect partition, that is partitions such that each contains only one partition of each lower number. For instance, for 7, a perfect partition is (4111), since we have only one partition of 1, 2, 3, 4, 5, 6. These are then applied to distributions upon a chess board. A connection is thus arrived at between magic squares and the general theory. The enumeration of Latin squares is effected by generating functions, thus solving a long-standing problem. For instance, the number of reduced Latin squares of order 1, is 1, of order 2, is 1, of order 3, is 1, of order 4, is 4, and of order 5, is 52.

Section six enumerates the partitions of multipartite numbers. A multipartite num-

ber is one that would be called in general algebra a multiplex, as (5, 3) or (3, 6, 2, 7).

Several tables of homogeneous functions, distribution functions, and enumerations close the first volume.

Section seven is devoted to the algebraic side of the partition of numbers, giving in some detail the present state of the theory, but omitting the purely arithmetic side. There are given here further developments connected with symmetric functions.

Section eight considers the theory of partitions as based upon Diophantine inequalities, generalizing the whole treatment. A chapter is devoted to the further study by this means of magic squares, the object being their enumeration rather than construction.

Sections nine and ten study partitions in two dimensions, including a complete solution of another long-standing problem. The problem of three-dimensional partitions relating to a cubic lattice is also attacked.

Section eleven relates to symmetric functions of several systems of quantities with applications to distribution functions.

The second volume closes with tables of symmetric functions of two systems, and enumeration of solid graphs.

If one were to undertake to characterize the treatise of Professor MacMahon briefly he would probably best state its field by saying that it is a development of the algebra of symmetric functions with applicatin to various generating expressions whose coefficients find use in enumeration problems of distribution. Professor MacMahon has occupied himself with the development of this theory for some years and the treatise is a systematic presentation of his results. No brief account can be given of the very skilful methods employed. It shows amply that alongside of the alternating functions so long studied in determinant forms, the symmetric functions are equally important and have their field of application. It exemplifies how different branches of mathematics can be correlated so as to be useful in reducing problems. It also draws strongly attention to the fact that there still remains in the field of algebraic form plenty of opportunity for the interested student to do research work of high order. Indeed it would seem that courses on symmetric functions at least should be offered alongside of other courses in algebra, such as theory of equations, determinants, groups, and the like. The whole theory of the construction of algebraic forms for certain specific purposes has been enriched here with a valuable contribution.

JAMES BYRNIE SHAW

SPECIAL ARTICLES

INHERITANCE OF OIL IN COTTON

THE table of oil percentages given below suggests the possibility of producing divergent strains or biotypes from a "variety" of cotton, the one having seeds relatively high in oil content, the other relatively low in oil content.

The top line of figures gives the analysis (ether extract) of the seed from several mother plants, followed in column by the analysis of the seed of three of their progeny plants, respectively.

	Parent						
	17.33	20.64	16.58	18.97	16.79	18.92	16.87
Progeny.....	18.21	22.00	17.16	22.10	17.75	19.37	18.47
	18.67	20.82	18.40	21.17	17.86	19.45	18.92
	19.13	21.06	17.86	21.36	17.52	19.19	18.40

The three "high" parents have an average of 19.51 per cent. oil, and their nine progeny plants an average of 20.72 per cent. oil.

The four "low" parents have an average of 16.89 per cent. oil, and their twelve progeny plants an average of 18.20 per cent. oil.

The maximum difference between parents is 4.06 per cent. oil, and the maximum difference between plants of the progeny generation is 4.94 per cent. oil.

A seasonal variation raising the oil content of all plants in the progeny year is noted.

A later report will give the correlation between oil content of the seed and other characters.

E. P. HUMBERT
AGRICULTURAL EXPERIMENT STATION,
COLLEGE STATION, TEXAS

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION D—MECHANICAL SCIENCE AND ENGINEERING. II

Recent Developments in Details of Construction of Brick Pavements on Green Concrete Foundation and Sand-Cement Superfoundation: William C. Perkins.

Discussion of new methods of constructing brick pavements. Two methods of construction: (1) The laying of the brick directly on the green concrete, commonly called "the monolithic construction." (2) The laying of the brick on a superfoundation of cement-sand commonly called "the semi-monolithic construction."

Advent of a brick 3 inches in depth due to the new methods of construction and discussion of the advantages of a 3-inch brick.

Discussion of the details of construction of the monolithic type.

Discussion of the details of construction of the semi-monolithic type.

(Slides will be used showing the different steps of construction.)

The Causes of Cracks in Cement-Concrete Pavements: A. T. Golldbeck.

This paper gives data on the relative effect of moisture and temperature in causing cracking of concrete pavements. The results of laboratory tests on the effect of moisture on concrete are given as well as the results of field measurements on concrete roads. Likewise some results of friction tests of concrete slabs on various sub-bases are presented and applied in analyzing the effect of expansion and contraction in causing cracks. Finally, the effect of lack of uniform support by the sub-base in causing longitudinal cracks is pointed out.

A Condition Survey of Concrete Roads in the United States: A. N. Johnson.

The Necessity for Adequate Methods of Waterproofing in Road Construction: B. A. Meyer and C. J. Morrison.

A wheel and a road may be considered as two elements of a machine and the ideal requisites for each determined to be:

1. Perfectly hard and perfectly round wheel.
2. Perfectly hard and level road.

The ideal road can not be maintained, but can be approached by constructing a moderately hard road which resists wear and disintegration.

In order to fulfil their requirements roads must be water-proof so as to protect them from the flowing, undermining and penetration of water. Principles of waterproofing are simple, but are neglected. Illustrated by drawings and pictures.

Roads are constructed under five general conditions:

1. On level ground.
2. On inclined ground.
3. In cuts.
4. On embankments.
5. On side of slopes.

Each condition requires a different method of waterproofing, and waterproofing is dependent upon:

1. Location of drains.
2. Construction of road.
3. Treatment of surface.

Comparative costs of construction and maintenance show that at the end of five years the total cost of a non-waterproof road and that of a semi-water-proof road are about equal, but that the former is practically useless while the latter shows little deterioration.

Similar comparisons for waterproof roads are not yet available.

Columbia River Highway: George C. Warren.

The fourth session was held in the morning, Friday, December 29, in the engineering building, Columbia University, Vice-president, Dr. Henry M. Howe in the chair, with an attendance of about 45.

The program of the session, which was devoted to general engineering, was as follows:

Modern Methods of Precise Leveling in the Coast and Geodetic Survey: William Bowie.

Development of the Systematic Hydrographic Survey: N. H. Heck.

Difference in popular and scientific attitude toward the two branches of the Coast and Geodetic Survey work.

Lack of appreciation of hydrographic problems with reasons. Conservatism of sea reacts on survey methods. Instances.

Numerous sources of possible error to be eliminated. Pressure of commercial needs interferes with experimental work.

Closer attention to care in location. Elimination of errors due to currents in certain offshore areas. Startling results of a simple change. Improvements in depth measurements. Possible errors in a long-established method.

Failure of vertical method of developing all bottom contours introduced need for wire drag method. Mathematical definition. Aims and classification.

Practise in deep water work. Outline of nature of problems in close to bottom wire drag surveys. Surface observation insufficient. Analysis of action of wire in striking an obstruction with observed phenomena. Geological phase. Experiments and conclusions.

Estimate of value of method and results. Improvements in apparatus and instruments. Standardization of measurements. Definite recognition of need for experiment and research in all branches will lead to continuous improvement in results.

The Engineer and the Newspaper: HENRY A. WISE WOOD.

Herein Mr. Wood first recounts the origin of the practise of engineering science as a civilian occupation. He then describes the slow development in printing during the first eighteen centuries, commencing with the manufacture of paper, and relates to the improvements as they took place up to the nineteenth century, when the engineer took the art in hand, transforming it from a hand-worked to an automatic basis. Mr. Wood then dwells on the more extensive improvements made in printing during the nineteenth century, particularly in the printing press.

Having brought the press to its present state of perfection, he enumerates the other improvements in printing. In connection with the composing room he expounds the revolutionary advantages of the linotype, and in disclosing the improvements made in the stereotyping room he explains the processes which transformed it from a hand-worked into an automatically-operated department—the autoplate, introduced early in the twentieth century, being the principal factor.

Mr. Wood then passes on to the newspaper's latest achievement, the stereotyper's dry matrix, with which the history of printing ends. And he closes with a prophecy that the next step forward in printing will be taken in the printing-press department.

Independent Laboratories in the Engineering Industries: CLAYTON H. SHARP.

The university is the proper place for pure scientific work; that is, work done without any commercial motive. The large manufacturing organizations have recognized the importance of industrial laboratory work and many of them have organized extensive laboratories for their own purposes. The small manufacturer, being unable to establish an efficient laboratory of his own, may take his work either to a technical school or to an independent industrial laboratory. The technical school is, however, unsuited for many classes of industrial work through limitations of equipment and because, being organized for purposes of education, industrial work does not fit properly into its scope. The best solution of the laboratory problem of the small manufacturer is recourse to independent laboratories, adequately manned and equipped and supported by the work which they do. Such laboratories may offer facilities quite comparable with those of the laboratories of the great corporations and should, if adequately supported, prove an important factor in industrial progress.

A Study of the Relation between Tension and Magnetic Permeability: JAMES T. ROOD.

Magnetic curves are commonly assumed to hold irrespective of conditions under which material is to be used. Is this correct?

Does tension effect permeability of magnetic materials?

Does this change with material?

What is the magnitude of this change?

Tests on cast iron showed permeability unaffected by tension.

Tests on wrought iron showed permeability considerably affected by tension. To top of knee of B–H curve, tension below a certain amount increased permeability, greater tensions decreased permeability. Above knee, all tensions up to elastic limit decreased permeability. Higher the stress, the greater the percentage decrease; higher the degree of saturation, the less the percentage decrease.

Tests on steel showed permeability to be affected in the same manner as wrought iron.

With these materials the increase and decrease in permeability may be as high as 20 per cent.

Effect seems to increase as elasticity of material decreases, but cast iron is an exception.

The presence of carbon may be a determining factor.

Notes on the Theory of the Air Core Auto-transformer: WALTER L. UPSON.

The theory of the auto-transformer, especially the non-ferric type, is worked out by the method of complex quantities. It is pointed out that the resistances and leakage reactances of air-core transformers being constant and the magnetizing current being directly proportional to the impressed voltage, the characteristic performance is entirely dependent on the voltage and when known for one value of voltage may be immediately found for any other voltage.

A brief discussion of the peculiar characteristics of this apparatus is indicated by theory is

given, and an example is worked out from assumed constants.

The paper is of a preliminary character, intended to open up the general problem and suggest what may be expected by a more exhaustive study from the experimental standpoint.

Medical Engineering: P. A. Maignen.

Medical engineering is defined as medicine viewed from the angle of engineering.

The author refers to the great interest manifested in our days in sanitary science (preventive medicine) and in medical subjects generally.

He defines engineering and points out the necessity for the engineer to be ingenious.

The various divisions of therapeutics—natural, applied, empirical and rational—are referred to.

Serum therapeutics is criticized.

The excessive fear of microbes is disapproved, but it must be recognized that more than half the diseases are of bacterial origin and that we must declare war against the bacteria, and carry it on with appropriate weapons on the surfaces without injuring the healthy tissues.

The author points out the procrastination of the sick, and the desirability of the state paying the physicians in civil life, as it already pays the army and navy surgeons. The education of the people in the rudiments of antiseptic therapeutics is also recommended.

The discovery of an effective, non-poisonous germicide is explained, and it is suggested that antiseptic surgery, which has been somewhat neglected of late, will return to the front.

He gives the formula of the new antiseptic, which is 3¾ times stronger than carbolic acid and may be taken internally in the respiratory and alimentary tracts.

A few words about tuberculosis and cancer close the paper.

Mathematical Education for Civil Engineers: D. J. McAdam.

The paper does not undertake to discuss the mathematical curriculum in our engineering schools as a whole, but points out some defects in the teaching of the standard subjects, algebra, the geometries, the trigonometries and calculus.

These defects are: (1) Wrong or defective statement and development of the fundamental propositions such as, for instance, in the definition and development of the trigonometric functions in trigonometry, and the proof of the rules for differentiation in calculus. (2) Insisting on secondary rules and formulæ with as much zeal as on the primary and fundamental. For instance, the multiplicity of formulæ in plane trigonometry, which should be developed from half a dozen, and in spherical trigonometry, which could be developed from less than half a dozen. (3) Burdening the student with useless details. Thus, in algebra he is required to commit the quotient having given dividend and divisor, and he is to remember four rules for solving a quadratic trinomial instead of one.

The Effect of Such Teaching.—(1) The student is made to carry in his mind—temporarily—such a mass of detail that he proceeds to forget it all, including the fundamentals.

(2) The student fails to get a mathematical education at all. He fails to grasp the true mathematical import who does not find in it a means of taking a few fundamental principles and with them working wonders.

(3) Such study of mathematics defeats the aim of even those who would have mathematics studied as a means of discipline. No study can be truly disciplinary which instead of awakening love and enthusiasm, begets discouragement and disgust.

The Remedy.—If teachers insist on following the text-book, then the remedy is in having prepared sets of books, which would present only fundamental propositions as primary, and give these secondary propositions as exercises.

In the calculus it is suggested that we have a set of small volumes, the first developing the fundamental propositions, the other volumes, each after unfolding the fundamentals, should follow this with problems wholly worked by the calculus.

Apparatus and Process for the Treatment of Western Grown Flax Straw for the Manufacture of Paper: George D. Burton.

State Engineering Experiment Station and Government Promotion of Industrial Research: Phinehas V. Stephens.

This paper discusses a system of state industrial research in state engineering experiment stations connected with a well organized and equipped engineering school and established under federal aid and supervision. The stations to be also supported and directed by the state for the purpose of prosecuting research in pure and applied science relating to industrial development, transportation, sanitation, irrigation, the utilization of our natural resources and the general problems of public welfare. The system includes the actual cooperation of the Department of Commerce and also that of engineering and scientific societies, manufacturers, foundations and individuals interested in scientific and industrial development.

The plan provides for the training of engineers as scientists and research experts, the use of graduate students for research and the employment of research experts as lecturers and instructors part time in the regular courses of engineering and science in the schools where the stations are established. There is included a universal research library system, making easily available the important information resulting from the researches in the proposed engineering experiment stations.

The fifth session was held in the evening of Friday, December 29, in the auditorium of the United Engineering Society building at the invitation of the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. Vice-president Dr. Henry M. Howe presided. The attendance was about 325.

The program of the session, which was devoted to the subject "Interrelationship of Engineering and Pure Science," was as follows:

Address by Dr. Henry M. Howe, vice-president, Section D, A. A. A. S., and past-president, American Institute of Mining Engineers.

Address by Dr. Bion J. Arnold, retiring vice-president, Section D, A. A. A. S., and past-president, American Institute of Electrical Engineers.

Address by Clemens Herschel, president, American Society of Civil Engineers.

Address by Dr. Ira N. Hollis, president, Worcester Polytechnic Institute, and president, American Society of Mechanical Engineers.

The session was followed by a reception, dance and collation tendered by the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers to the American Association for the Advancement of Science.

ARTHUR H. BLANCHARD,
Secretary

MINUTES OF THE COUNCIL

THE council met in the U. S. National Museum, Washington, D. C., on Tuesday, April 17, 1917, at 4:45 P.M., Mr. Humphreys, vice-president, in the chair. The following members were present: Messrs. Van Hise, Pickering, Nichols, Cattell, Fairchild, W. A. Noyes, Merritt, Kober, Humphreys and Howard.

The committee on policy submitted a report through its chairman, Mr. Nichols, and, on recommendation, the following actions were taken by the council:

On nomination, Mr. E. L. Thorndike, of Columbia University, was elected vice-president and chairman of Section H, in place of Mr. E. B. Titchener, declined. On nomination, Mr. E. K. Strong, of Nashville, was elected as secretary of Section H for the unexpired term of one year, vice Mr. MacCurdy, resigned.

On motion, the following societies were admitted to affiliation with the American Associotion for the Advancement of Science with privilege of the waiving of the entrance fee to such of their members as may join the American Association for the Advancement of Science during the current year:
Society of College Teachers of Education,
National Society for the Study of Education.

On motion, the general secretary was instructed to inform the officers of the National Education Association that the American Association for the Advancement of Science would welcome the National Education Association as an affiliated society. It was moved to amend the original recommendation of the committee on policy to include also the American Association of University Professors in the above action.

On motion, it was resolved that the general secretary be authorized to prepare and publish, with the assistance of the permanent secretary, a membership list of the American Association for the Advancement of Science provided it could be done without expense to the association.

An informal report was made by Mr. Nichols to the effect that the proposed alterations to the constitution and the formulation of by-laws were in definite shape and would be ready for presentation at an early date. It was, on motion, resolved that, upon the completion of the committee's work, the results be published in SCIENCE with such memoranda as may be desirable, this publication to be at least one month prior to the Pittsburgh meeting. On separate motion, it was resolved that the publication carry with it an invitation for comment from members.

The permanent secretary read a tabulated list covering the accessions of new members during the past year under the Columbus resolution waiving the entrance fee to members of affiliated societies.

The permanent secretary presented his financial report for the fiscal year, November 1, 1915, to October 31, 1916, which, on motion, was accepted and ordered printed in SCIENCE.

Through its secretary, the committee on grants made an informal report covering the recommendations of the committee for the disposal of the $4,000 currently available, with the understanding that the full report will be published in an early issue of SCIENCE. Mr. Pickering, chairman of the above committee, stated that the committee favored the expenditure each year of the entire amount available.

A letter from the Pacific Division with regard to the activities of that division in connection with matters of preparedness policy on the Pacific coast, was read by the permanent secretary. On motion the permanent secretary was instructed to inform the Pacific Division of the appreciation of the council of the important work which that division is accomplishing.

At 5:20 P.M., the council adjourned.

L. O. HOWARD,
Permanent Secretary

FINANCIAL REPORT OF THE PERMANENT SECRETARY

L. O. HOWARD, PERMANENT SECRETARY, IN ACCOUNT WITH THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

FROM NOVEMBER 1, 1915, TO OCTOBER 31, 1916

Dr.

To balance from last account		$4,616.04
To receipts from members:		
Annual dues, 1916	$30,856.00	
Annual dues, 1917	170.00	
Annual dues, previous years	320.00	
Admission fees	1,255.00	
Associate membership fees	12.00	
Life membership fees	1,000.00	$33,613.00
To other receipts:		
Sale of publications	52.52	
Miscellaneous receipts, as follows:		
One (1) patron ($50 previously paid for life membership	950.00	
Treasurer's payment towards subscriptions to SCIENCE for life members, two years—1914 and 1915	793.89	
Interest on deposits, sale of programs, postage, refund from Columbus local committee.	442.47	$2,238.88
		$40,467.92

Cr.

By publications:		
Publishers SCIENCE	$21,292.05	
Preliminary announcement, circulars, forms, etc.	854.87	$22,146.92
By expenses Columbus meeting:		
To secretaries of sections, general secretary and secretary of council	666.78	
To badges, help and general expenses	272.68	939.46
By expenses of Pacific Division:		
To salary of assistant secretary	1,200.00	
To allowance for office expenses	600.00	
To allowance for extension of membership	521.55	$2,321.55
By expenses of Washington office:		
To salary of permanent secretary	1,500.00	
To salary of assistant secretary	1,500.00	
To extra help	984.07	
To postage	1,288.67	
To office supplies, stamp affixer, etc.	170.74	
To expressage, telephone and telegrams	89.96	$5,533.44
By propagandist work:		
To clerical assistance	1,265.07	
To postage	1,974.00	
To stationery and printing	1,693.05	$4,932.12
By miscellaneous disbursements:		
To treasurer, transfer of Colburn bequest	750.00	
To refund of dues	8.00	$758.00
		$36,631.49
By balance to new account		$3,836.43
		$40,467.92

The foregoing account has been examined and found correct, the expenditures being supported by proper vouchers. The balance of $3,836.43 is with the following Washington, D. C., banks:

American National Bank of Washington	$1,599.95
American Security & Trust Company	2,236.48
	$3,836.43

HERBERT A. GILL,
Auditor

WASHINGTON, D. C.,
April 16, 1917